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MAY 1963

OOAMA

AIRMUNITIONS TEST REPORT

SERVICE AND SHELF LIFE OF
SEV 44B EXPLOSIVE VALVE-IM99A

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SERVICE AND SHELF LIFE OF
SEV 44B EXPLOSIVE VALVE - IM99A

by

Don F. Woods

PUBLICATION REVIEW

This report has been reviewed and is approved



ALEX D. PERESICH
Chief, Engineering and
Test Division
2705th Airmunitions Wing

MAY 1963

2705TH AIRMUNITIONS WING
OGDEN AIR MATERIEL AREA
AIR FORCE LOGISTICS COMMAND
UNITED STATES AIR FORCE
Hill Air Force Base, Utah

NOTICES

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The conclusions and recommendations made in this report are not to be considered directive in nature. This type information becomes official only when published in Technical Orders or other applicable Air Force publications.

Qualified requesters may obtain copies of this report from DDC.

ADMINISTRATIVE DATA

PURPOSE OF TEST:

The purpose of this test was to determine if the service and shelf life of the SEV-44B explosive valve could be extended.

MANUFACTURER:

Conax Corporation, Buffalo, New York

ITEM IDENTIFICATION:

Federal Stock Number 1336-768-7907

Part Number EL-168

Nomenclature, Explosive Valve, SEV 44B

QUANTITY OF ITEMS TESTED:

29 SEV 44B Valves

15 Hot (160°F)

14 Cold (-65°F)

SECURITY CLASSIFICATION:

Unclassified

DATE TESTED:

March 1963

TEST CONDUCTED BY:

OOAMA (OOYET - 2705th Airmunitions Wing)

Test Director: Richard O. Miller, Captain, USAF

Project Officer: Don F. Woods, Mechanical Engineer

Test Directive: M-2-765-Y

OOY-TR-63-18

DISPOSITION OF SPECIMENS:

All metal components, generated from this test were inspected and certified inert in accordance with Technical Order 11C3-1-3. These components were then turned over to the Redistribution and Marketing Division.

ABSTRACT

The SEV 44B explosive valve is used to control the flow of ammonia from the IM99A nose cooling unit storage tank to the heat exchanger. The purpose of this test was to determine if the shelf and service life could be extended.

The current shelf life and service life of the SEV 44B valve are 3 years and 2 years respectively. Because of this limitation, it was necessary to replace these valves when this time was reached or to determine if their service life could be extended.

Twenty-nine samples were tested. These specimens were visually inspected, radiographed and temperature conditioned prior to testing. During testing, the valves were pressurized to 200 psig with nitrogen to simulate the pressure of the ammonia tank.

All valves functioned satisfactorily. The minimum firing voltage (6.5 - 10 volts) was well above the specification maximum no fire voltage of 3 volts. The minimum operating current (.27 - .40 amps) was less than that called out by the specification (.5 amp) but was within the calculated value.

Demonstrated reliability was 90.2 per cent at a confidence limit of 95 per cent. The valves were between 3.5 years and 4 years old when functioned.

It is recommended that the service life of the SEV 44B valve be extended to four years and the shelf life to five years.

TABLE OF CONTENTS

	PAGE
Notices	ii
Administrative Data	iii
Abstract	v
Table of Contents	vi
Introduction	1
Description	1
Figure 1	2
Test Samples	3
Test Procedures	3
Figure 2	4
Figure 3	6
Test Results	5
Table 1	7
Conclusions and Recommendations	8
Distribution List	9

INTRODUCTION

The SEV 44B explosive valve is a normally closed valve used on the IM99A nose cooling system. Its purpose is to prevent flow of ammonia from the cooling system storage tank to the heat exchanger until the system is activated.

Currently, this explosive valve has a two year service life and three year shelf life. As the service life expired, the actuators were removed from missiles and sent to OOAMA for testing to determine if service and shelf life could be extended.

The valve has a spring reinforced rubber hose, six and one half inches long attached to the inlet port. This hose is replaced every two years as deterioration occurs from contact with the ammonia in the storage tank. The rubber hoses were removed and were not considered in the evaluation of the valve as the hose will have to be replaced at two year intervals regardless of the service life of the valve body.

The tests were conducted under Test Directive and Standing Operating Procedure M-2-765-Y. This document was prepared by the Ground Launch Missile Branch, 2705th Airmunitions Wing.

DESCRIPTION

The SEV 44B explosive valve (Figure 1) is a normally closed valve activated by an explosive driven ram. The valve inlet and outlet ports are located normal to each other and are separated by a diaphragm machined into the aluminum valve body. The explosive driven ram is equipped with a conical cutter that punches through the diaphragm opening the valve.

The valve is "L" shaped with arms approximately four inches and two inches in length and 3/4 inch in diameter. The inlet port is equipped with a spring reinforced rubber hose six and one-half inches in length terminating in a lead weight. The hose and weight extend into the ammonia tank insuring continuous flow of liquid ammonia regardless of the level of the ammonia.

The explosive charge is one S-130-L squib. The electrical circuit includes an internal resistance designed to bring the total circuit resistance to 21 ± 1 ohm. Two electrical leads approximately 18 inches long are provided.

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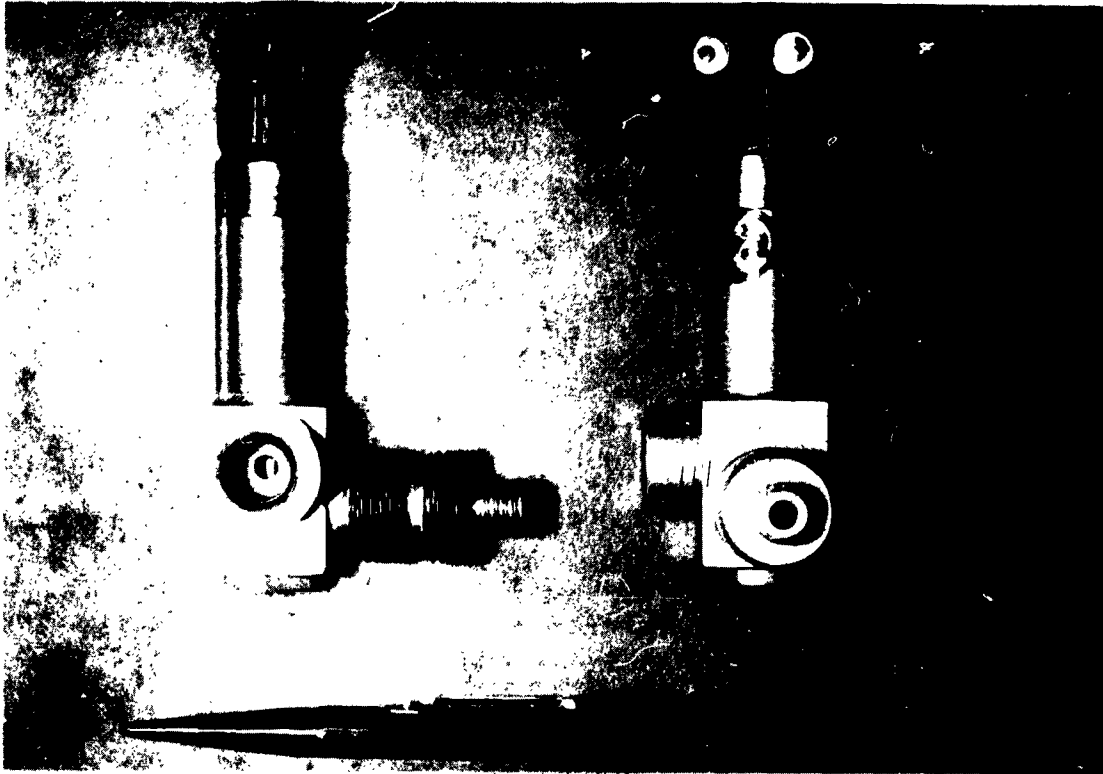


FIGURE 1. SEV 44B Explosive Valve.

TEST SAMPLES

The date of manufacture was not marked on the majority of the test specimens. The manufactured date was obtained by cross referencing each valve serial number with manufacturing dates taken from ammunition data cards.

TEST PROCEDURES

INSPECTION

The rubber hose was removed from each valve. All explosive valves were then radiographed and visually inspected prior to testing. No manufacturing defects of any kind were found. Only six valves had a date of manufacture stamped on them. All valves were marked with a legible serial number. The dates of manufacture stamped on the valves were not the same as those obtained from ammunition data cards. Comparison of the dates obtained from the samples, and the manufacturing dates obtained from the data cards are as follows:

<u>VALVE SERIAL NUMBER</u>	<u>DATE ON VALVE</u>	<u>DATE ON DATA CARD</u>
9200066	Oct 58	Apr 59
9200098	Jan 59	Apr 59
9200264	Oct 59	Sep 59
9200271	Oct 59	Sep 59
9200279	Oct 59	Sep 59
9200283	Oct 59	Sep 59

There was no pattern in the date discrepancy since two of the dates obtained from the data cards were later than those stamped on the valves and four were earlier.

The first three threads of the rubber hose attachment stud were slightly corroded on two valves (Figure 2). This condition, unless severe, would not affect the serviceability of the valves as the hose was fastened to the stud with clamps as well as having the reinforcement spring twisted around the stud. After functioning, the diaphragm of the valve having the greatest amount of thread corrosion, was removed from the valve body and visually examined.

00Y-TR-63-18



FIGURE 2. SEV 44B Explosive Valve Connected to Nitrogen Bottle for Testing.

TEMPERATURE CONDITIONING

Fifteen valves were temperature conditioned at 160°F for 30 hours and 14 valves were cold soaked at -65°F for 30 hours prior to testing.

TESTING

The electrical resistance of each valve was measured. The resistance of all valves except one were within the specification limit (21 ± 1 ohm). One valve (serial number 9200047) had a resistance of 15.64 ohm.

The inlet port of each valve was pressurized to 200 psig with nitrogen to simulate the ammonia tank pressure (Figure 3). The valves were fired using a variable DC voltage source. The voltage was increased until the valve fired.

TEST RESULTS

All valves fired satisfactorily (Table 1 contains tabulated test data). The minimum firing voltage (6.5 - 10 volts) was well above the specification maximum no fire voltage of 3 volts. The minimum operating current (.27 - .40 amps) was less than that called out by the specification (.5 amp) but was within the calculated value from the resistance and applied voltage.

The first three threads of the hose attachment stud, on two valves were corroded. The ammonia separation diaphragm of the valve having the greatest corrosion was examined. No corrosion was present.

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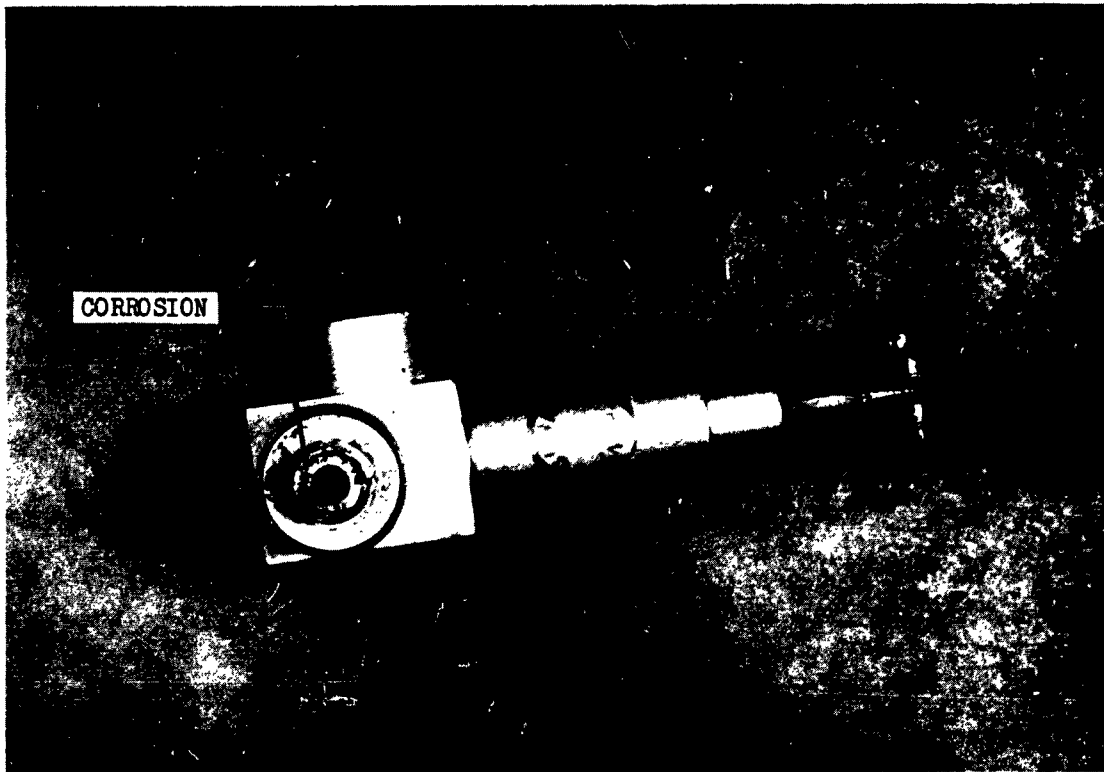


FIGURE 3. Corrosion of Hose Attachment Stud.

SERIAL NUMBER	TEMP °F	RESISTANCE OHM	FIRING VOLTAGE	FIRING CURRENT	DATE
800107 *	+160	21.05	7	.31	
9200047	+160	15.65	5	.29	Apr 59
9200066	-65	20.55	8.5	.34	Apr 59
9200079	+160	20.85	6.5	.29	Apr 59
9200092	-65	21.05	8.5	.37	Apr 59
9200098	-65	20.75	10	.50	Apr 59
9200126	-65	20.95	8.2	.35	Apr 59
9200132	-65	21.25	8	.40	Apr 59
9200135	-65	20.95	9	.36	Apr 59
9200141	+160	21.05	6.5	.28	Apr 59
9200142	-65	21.05	8	.36	Apr 59
9200146	-65	21.05	8	.34	Apr 59
9200163	+160	21.25	7.9	.33	Apr 59
9200166	+160	21.15	7	.31	Apr 59
9200182	-65	20.65	8.2	.36	Jul 59
9200184	+160	20.55	6	.27	Jul 59
9200187	+160	21.75	7	.29	Jul 59
9200214	+160	20.65	6.5	.30	Oct 59
9200257	+160	21.25	8	.34	Sep 59
9200264	+160	21.35	8	.32	Sep 59
9200271	+160	21.25	6.5	.28	Sep 59
9200279	-65	21.55	8	.34	Sep 59
9200283	-65	21.55	8	.35	Sep 59
9200290	+160	20.75	6.9	.28	Dec 59
9200306	-65	20.95	9.5	.40	Dec 59
9200318	-65	20.95	8	.34	Apr 60
9200320	-65	20.65	8	.35	Apr 60
9200336	+160	20.75	7	.28	Apr 60
9200347	+160	21.05	8	.32	Apr 60

TABLE 1. Test Results.

* This serial number could not be located on Ammunition Data Cards and appears to be in error.

CONCLUSIONS AND RECOMMENDATIONS

The corrosion of the hose attachment stud threads was probably due to galvanic action between the aluminum stud and the steel hose spring. Probably the protective coating on the valve stud was damaged allowing contact of the two dissimilar materials. Moisture entering the valve through the rubber hose after the valve was removed from its container could have caused the corrosion.

The SEV 44B explosive valve functioned satisfactorily at an age of nearly four years.

The minimum reliability demonstrated at a 95 per cent confidence limit was 90.2 per cent (29 items tested with no failures).

It is recommended that the service life and shelf life of the SEV 44B valve be extended to four years and five years, respectively, from the date of manufacture. After the valves have been in service four years, they should again be tested to determine if further life extension is possible.

NOTE

The recommendation for service life extension does not apply to the rubber hose assembly.

Each time the rubber hose is replaced, the hose attachment stud should be examined. The valve should be replaced if the threads have deteriorated to such an extent that a tight connection cannot be made.

NOTE

The explosive actuator portion of the SEV 44B valve is very similar to the TX 53 trigger device (FSN 1336-874-9893). The TX 53 trigger device has been tested (Airmunitions Test Report OOY-TR-63-5), and the service life extended to five years.

DISTRIBUTION LIST

- 3 Dep IG, Directorate of Aerospace Safety, Hq USAF (AFIAS-G2)
Norton AFB, Calif
- 1 Hq USAF (AFSSS-AE), Washington 25, DC
- 2 AFLC (MCSWT & MCASS), Wright-Patterson AFB, Ohio
- 1 AUL, Maxwell AFB, Ala
- 20 Hq DDC (TISIA-2), Arlington Hall Stn, Arlington 12, Va
- 1 Bureau of Naval Wpns (Code RMMO-5), Dep of the Navy, Wash 25, DC
- 1 CO, US Army Mtel Comd Field Safety Agcy, Charlestown, Ind
- 1 Safety Div (AMCAD-SA), US Army Mtel Comd, Wash 25, DC
- 1 US Army Ammunition Procurement and Sup Agcy (SMUAP-Q), Joliet, Ill
- 1 Hq AFSC (SCMMS-3), Andrews AFB, Wash 25, DC
- 1 CO, Picatinny Arsenal (Tech Info Lib), Dover, NJ
- 1 MATS (MAMSS/SBG), Scott AFB, Ill
- 1 Tech Lib (Code T2), US Naval Propellant Plant, Indian Head, Md
- 11 OOAMA (1-OOYIT, 1-OOYID, 1-OOYS, 1-OOYEO, 2-OOK, 5-OOYEG),
Hill AFB, Utah
- 4 ADC (ADMME-EC), Ent AFB, Colo
- 1 Det 4, ASD (ASQNW), Eglin AFB, Fla
- 2 US Army Missile Comd (AMSMI-SEC), Redstone Arsenal, Ala
- 1 AFPRO, Boeing Co, Seattle Wash
- 1 Hq ASD (Bomarc Project Office), Wright-Patterson AFB, Ohio
- 1 BSD (Tech Lib), Norton AFB, Calif

<p>AD 2705th Airammations Wing (COMMA), Hill Air Force Base, Utah SERVICE AND SHELF LIFE OF SEV 44B EXPLOSIVE VALVES - IN99A, by Don F. Woods, May 1963, 9p incl. figures and table. (COT-7A-63-18) Unclassified Report</p> <p>The SEV 44B explosive valve is used to control the flow of ammonia from the IN99A nose cooling unit storage tank to the heat exchanger. The purpose of this test was to determine if the shelf and service life could be extended. The current shelf life and service life of the SEV 44B valve are 3 years and 2 years respectively. Because of this limitation, it was necessary to replace these valves when this time was reached or to determine if their service life could be extended. Twenty-nine samples were tested. These specimens were visually inspected, radiographed and temperature conditioned prior to testing. During testing, the valves were pressurized to 200 psig with nitrogen to simulate the pressure of the ammonia tank. All valves functioned satisfactorily. The minimum firing voltage (6.5 - 10 volts) was well above the specification maximum no fire voltage of 3 volts. The minimum operating current (.27 - .40 amps) was less than that called out by the specification (.5 amp) but was within the calculated value. Demonstrated reliability was 90.2 per cent at a confidence limit of 95 per cent. The valves were between 3.5 years and 4 years old when functioned. It is recommended that the service life of the SEV 44B valve be extended to four years and the shelf life to five years.</p>	<p>UNCLASSIFIED</p> <p>1. Explosive Valve SEV 44B I. Don F. Woods</p>	<p>AD 2705th Airammations Wing (COMMA), Hill Air Force Base, Utah SERVICE AND SHELF LIFE OF SEV 44B EXPLOSIVE VALVES - IN99A, by Don F. Woods, May 1963, 9p incl. figures and table. (COT-7A-63-18) Unclassified Report</p> <p>The SEV 44B explosive valve is used to control the flow of ammonia from the IN99A nose cooling unit storage tank to the heat exchanger. The purpose of this test was to determine if the shelf and service life could be extended. The current shelf life and service life of the SEV 44B valve are 3 years and 2 years respectively. Because of this limitation, it was necessary to replace these valves when this time was reached or to determine if their service life could be extended. Twenty-nine samples were tested. These specimens were visually inspected, radiographed and temperature conditioned prior to testing. During testing, the valves were pressurized to 200 psig with nitrogen to simulate the pressure of the ammonia tank. All valves functioned satisfactorily. The minimum firing voltage (6.5 - 10 volts) was well above the specification maximum no fire voltage of 3 volts. The minimum operating current (.27 - .40 amps) was less than that called out by the specification (.5 amp) but was within the calculated value. Demonstrated reliability was 90.2 per cent at a confidence limit of 95 per cent. The valves were between 3.5 years and 4 years old when functioned. It is recommended that the service life of the SEV 44B valve be extended to four years and the shelf life to five years.</p>	<p>UNCLASSIFIED</p> <p>1. Explosive Valve SEV 44B I. Don F. Woods</p>
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